

b7 This invention relates to an apparatus for displaying a 3-dimensional image from at least two plane images. The apparatus comprises first and second image display devices, and first and second mirrors. The first and second image display devices receive first and second plane images of an object and invert the left and right sides of the first and second plane images, respectively, and to output the inverted first and second plane images, respectively, each image being produced at first and second positions with respect to the object. The first and second mirror are located between the first and second display devices and configured to receive and reflect the first and second inverted images in a first direction, respectively. The first and second display devices are located on opposite sides of the first and second mirrors.

REMARKS

In response to the Office Action mailed July 25, 2002, Applicant respectfully requests the Examiner to reconsider the above-captioned application in view of the above amendments and the following comments.

Claims 16-18 and 25-27 have been canceled. Claims 1, 5, 9, 15, 19 and 20 have been amended. The amendments to Claims 1, 9 and 20 are supported, for example, by the specification at page 8, lines 16-19. The amendments to Claim 5 are supported, for example, by the specification at page 11, lines 12-15 and 20-23. The amendments to Claim 19 are supported, for example, by the specification at page 6, lines 13-21, and at page 8, lines 16-19. The amendments to Claims 28-31 are supported, for example, by the specification at page 9, lines 25-27, and at page 10, lines 17-18 and 22-23. The amendments to Claim 15 clarify the original subject matter.

Claims 28-38 have been added. New Claims 28-32 and 38 are supported, for example, by the specification at page 10, lines 16-18 and 20-23. New Claims 33-37 are supported, for example, by original Claims 10-14.

Thus, the claim amendments and additions do not introduce any new matter. As a result of the amendment listed above, Claims 1-15, 19-24, and 28-38 are pending in this application.

The specific changes to the amended claims are shown on a separate set of pages attached hereto and entitled VERSION WITH MARKINGS TO SHOW CHANGES MADE, which follows the signature page of this Amendment. On this set of pages, the insertions are double underlined while the ~~deletions are struck through~~.

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Discussion of Substitute Specification

Applicant has corrected all of typographical errors and inconsistency of the specification including the discrepancies (reference numeral "12", and typographical error "Is") pointed out by the Examiner.

According to 37 C.F.R. § 1.125, Applicant hereby submits a substitute specification. All the changes (including the matter being added to and the matter being deleted from) made in the substitute specification are supported by the original specification and drawings. Thus, the substitute specification includes no new matter. A marked up version of the substitute specification showing all the changes to the specification, and a version of the substitute specification without markings as to amended material are submitted with this paper. On the marked up version, the additions are double underlined while the ~~deletions are struck through~~.

Discussion of Drawing Amendments

Applicant has amended Figures 4 and 5 so as to be consistent with the specification. Since in Figure 4 the inverting apparatuses (16b, 26b) do not perform inverting an image, the elements (16b, 26b) have been deleted from the specification for clarity. Accordingly, the inverting apparatuses (16b, 26b) have been removed from Figure 4.

Similarly, since in Figure 5 the inverting apparatuses (16c, 26c) do not perform inverting an image, the elements (16c, 26c) have been deleted from the specification for clarity. Accordingly, the inverting apparatuses (16c, 26c) have been removed from Figure 5.

Thus, the drawing changes do not introduce any new matter to the subject matter. Applicant submits the formal drawings for amended Figures 4 and 5 herewith.

Discussion of Rejection of Claims under 35 U.S.C. § 102(b)

The Examiner has rejected Claims 1-3, 9-10, 13-14, 19-20 and 24 under 35 U.S.C. §102(b) as being anticipated by Allard, et al. (U.S. Patent No. 4,743,964). The Examiner asserts that the Allard reference discloses all of the elements in the claims. However, Applicant respectfully disagrees with the Examiner as discussed below.

Presently pending Claim 1 recites, among other things, left and right plane image display devices for simultaneously outputting the inverted left and right plane images. Presently pending Claim 9 recites, among other things, first and second image display devices configured to

substantially simultaneously output the inverted first and second plane images. Presently pending Claim 19 recites, among other things, a first image display device configured to output the inverted first plane image. Presently pending Claim 20 recites, among other things, displaying substantially simultaneously outputting the inverted first and second plane images. However, the Allard patent does not disclose any of the above features recited in the above claims.

Referring to Figure 1 and column 3, lines 3-12 and column 3, line 63 through column 4, line 6, Allard discloses a pair of display devices (12, 22) displaying stereoscopic images, two reflection mirrors (14, 24) inverting the displayed images, and a pair of reflection mirrors (15, 25) reflecting the inverted images to the viewer. That is, the Allard invention performs the inverting of each of the displayed images using the two reflection mirrors (14, 24). However, in the Allard patent, each of the images is inverted by the reflection mirrors (14, 24) after the images are output from the display devices (12, 22). This means that the display devices (12, 22) output (display) original images, i.e., non-inverting images.

In contrast, in the claimed invention, the display device(s) output(s) the inverted plane images, or the inverted plane images are displayed.

Thus, presently pending Claims 1, 9, 19 and 20 are neither anticipated by nor would have been made obvious by the Allard reference. The remaining claims depend from one of corresponding base Claims 1, 9, 19 and 20 and further define additional technical features. In view of patentability of their base claims and further additional features, the dependent claims are also patentable.

Discussion of Rejection of Claims under 35 U.S.C. § 103(a)

1. Discussion regarding Claims 4 and 23

The Examiner has rejected Claims 4 and 23 under 35 U.S.C. §103(a) as being unpatentable over Allard, et al. (U.S. Patent No. 4,743,964). Claims 4 and 23 depend from Claims 1 and 20, respectively. Since at least Claims 1 and 20 are patentable over the Allard reference as discussed above, the dependent Claims 4 and 23 are also patentable.

2. Discussion regarding Claims 5-8, 11,12, 15-18, 21, 22 and 25-27

The Examiner has rejected Claims 5-8, 11, 12, 15-18, 21, 22 and 25-27 under 35 U.S.C.

§103(a) as being unpatentable over Allard, et al. (U.S. Patent No. 4,743,964) in view of Ricks (U.S. Patent No. 4,190,856).

Presently pending Claim 5 recites, among other things, first left and right plane image display devices for simultaneously outputting the inverted left and right plane images, which is a similar limitation to that discussed with regard to Claim 1. Thus, the Allard patent does not disclose the above features recited in Claim 5.

The Allard reference is directed to displaying a stereoscopic image using a pair of two-dimensional images. The Ricks invention is directed to generating a three dimensional image using "sectioning" technology that forms a three-dimensional picture by stacking a set of cross-sectional representations along a common optical axis (Figure 2; column 2, line 43 through column 3, line 23). The sectioning technology produces a three dimensional image in a completely different way than the stereoscopic method (column 1, line 65 through column 2, line 28, and Figure 1). Thus, no suggestion or motivation to combine the teachings to create the claimed invention of Claim 5 exists in either of the references.

Furthermore, if they were combined, the combination does not teach the features recited in Claim 5 because neither Allard nor Ricks discloses first left and right plane image display devices for simultaneously outputting the inverted left and right plane images.

Therefore, Claim 5 is patentable over Allard in view of Ricks. Regarding Claims 6-8, they depend from Claim 5 and further define additional technical features. Since at least Claim 5 is patentable, the dependent claims are also patentable.

Claims 16-18 and 25-27 have been canceled. Regarding Claims 11-12, 15, 21-22, they depend from one of the base claims (Claims 9 and 20) and further define additional technical features. As discussed above, since at least Claims 9 and 20 are patentable, the dependent claims are also patentable.

Discussion regarding other references

The Examiner asserts that each of Carollo (U.S. Patent No. 5,912,650) and Hoshi (U.S. Patent No. 5,825,539) also discloses all of the elements of the claimed invention recited in Claim 1. However, none of the references discloses the claimed invention of Claim 1 as discussed below.

The Carollo reference at best discloses a pair of image generators (101, 105) and a pair of

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reflection mirrors (109) as shown in Figure 1. The Carollo reference says nothing about an image inverting in the image generators (101, 105).

The Hoshi reference at best discloses a pair of image display means (5L, 5R) and a pair of relay optical system (3L, 3R), and a half mirror system (2L, 2R) as shown in Figures 1-3 and 13-14. The Hoshi reference says nothing about an image inverting in the image display means (5L, 5R).

Thus, neither Carollo nor Hoshi discloses the limitation "first and second image display devices configured to substantially simultaneously output the inverted first and second plane images" or similar limitations as discussed above. Thus, all of the pending claims are not anticipated nor would have been made obvious by the Carollo and Hoshi references.

Discussion of Objection of the Disclosure

1. The Abstract

The Examiner has objected to the abstract because it exceeds 150 words. Applicant has amended the abstract, accordingly.

2. The Specification

The Examiner has objected to the specification because of some typographical errors. As discussed above with regard to the substitute specification, Applicant has corrected any discrepancies which were found by Applicant including the typographical errors indicated by the Examiner.

Discussion of Objection of the Claims

The Examiner has objected to Claims 1-15 and 19-24 because of some informalities. The Examiner asserts that there is no reference to a screen of Claim 1 in the specification and drawings. The Examiner also asserts that there are some discrepancies between the claims and the disclosure as to when the inverting of the plane images is performed. Applicant has clarified independent Claims 1, 5, 9, 19 and 20 in connection with the objections indicated by the Examiner. Thus, withdrawal of the objection is respectfully requested.

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Discussion of Priority Document

The Examiner has indicated that a certified copy of the priority Korean application, No. 10-2000-30643, has not been filed. Applicant will shortly submit a certified copy of the Korean application.

Discussion of New Claims

New Claims 28-31 depend from one of the base claims (Claims 1, 5, 9 and 19) and further define additional technical features. In view of patentability of the base claims and additional features, new Claims 28-31 are patentable.

New Claim 32 recites, among other things, first and second image display devices configured to substantially simultaneously output the inverted first and second plane images, which is a similar limitation to that of Claim 9. Thus, new Claim 32 is patentable over all of the above references. New Claims 33-37 depend from Claim 32 and further define additional subject matter. Since at least Claim 32 is patentable, the dependent Claims 33-37 are also patentable.

New Claim 38 recites, among other things, inverting the left and right sides of the first and second plane images in first and second display devices. As discussed above, none of the references discloses inverting the left and right sides of the first and second plane images in first and second display devices. Thus, new Claim 38 is patentable over all of the above references.

Summary

In view of the above, presently pending Claims 1-15, 19-24, and 28-38 are neither anticipated by nor would have been made obvious by any of the above references. Therefore, withdrawal of the rejection is respectfully requested.

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CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. If the Examiner has any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the indicated telephone number.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend Claims 1, 5, 9, 15, 19 and 20 as follows.

1. (AMENDED) An apparatus for generating a 3-dimensional image from at least two plane images, comprising:

left and right image inverting devices for receiving left and right plane images of an object and inverting the left and right sides of the left and right images, respectively, each plane image being produced at different positions with respect to the object;

left and right plane image display devices for simultaneously outputting the inverted left and right plane images ~~received with respect to the same object from left and right sides to a screen;~~

~~left and right image inverting devices for inverting original left and right images and outputting inverted left and right images;~~

a left reflection mirror, on which the inverted left image is incident and reflected at the same angle, so that the reflected left image is perceived by a left eye of a viewer;
and

a right reflection mirror, on which the inverted right image is incident and reflected at the same angle, so that the reflected right image is perceived by a right eye of a viewer.

5. (AMENDED) An apparatus for generating a 3-dimensional image from at least two plane images, comprising:

left and right image inverting devices for receiving left and right plane images of a first object and inverting the left and right sides of the left and right images, respectively, each plane image being produced at different positions with respect to the first object;

first left and right plane image display devices for simultaneously outputting the inverted left and right same plane images ~~from left and right sides;~~

second left and right plane image display devices for simultaneously outputting original left and right plane images of a second object, each image being produced at different positions with respect to the second object ~~the same plane images from left and~~

~~right sides which are different from the images output from the first left and right plane image display devices;~~

~~left and right image inverting devices for inverting original left and right images and outputting inverted left and right images;~~

~~a first left mirror for synthesizing an the inverted left image output from the left plane image display device after inversion by the left image inverting device which is incident at a predetermined angle and the original left image output from the second left plane image display device which is incident at a predetermined angle, and outputting a left synthesized image;~~

~~a first right mirror for synthesizing an the inverted right image output from the right plane image display device after inversion by the right image inverting device which is incident at a predetermined angle and the original right image output from the second right plane image display device which is incident at a predetermined angle, and outputting a right synthesized image;~~

~~a second left mirror, on which the left synthesized image is incident and reflected at the same angle, so that the left synthesized image is perceived by a left eye of a viewer; and~~

~~a second right mirror, on which the right synthesized image is incident and reflected at the same angle, so that the right synthesized image is perceived by a right eye of a viewer.~~

9. (AMENDED) An apparatus for generating a 3-dimensional image from at least two plane images, comprising:

first and second inverting devices configured to receive first and second plane images of a first object and invert the left and right sides of the first and second plane images, respectively, each image being produced at first and second positions with respect to the first object;

~~first and second image display devices configured to substantially simultaneously output the inverted first and second plane images for a first object, respectively, each image being produced at first and second positions with respect to the first object;~~

~~first and second inverting devices configured to invert the left and right sides of the first and second plane images, respectively;~~

a first mirror located between the first and second display devices and configured to receive and reflect the first inverted image in a first direction; and

a second mirror located between the first and second display devices and configured to receive and reflect the second inverted image in the first direction;

wherein the first and second display devices are located on opposite sides of the first and second mirrors.

15. (AMENDED) The apparatus of Claim 9, further comprising:

third and fourth image display devices configured to substantially simultaneously output ~~first and second~~ third and fourth plane images ~~for~~ of a second object, respectively, each image being produced at different positions with respect to the second object;

a third mirror located between the first display device and the first mirror, the third mirror having first and second sides opposing each other, the first side of the third mirror being configured to receive and transmit the first inverted image to the first mirror, the second side of the third mirror being configured to receive and reflect the third image to the first mirror; and

a fourth mirror located between the second display device and the second mirror, the fourth mirror having first and second sides opposing each other, the first side of the fourth mirror being configured to receive and transmit the second inverted plane image to the second mirror, the second side of the fourth mirror being configured to receive and reflect the fourth image to the second mirror;

wherein the first and second mirrors are configured to reflect the transmitted and reflected images from the third and fourth mirrors in the first direction, respectively.

19. (AMENDED) An apparatus for generating a 3-dimensional image from at least two plane images, comprising:

~~first and second image display devices configured to substantially simultaneously output first and second plane images for a first object, respectively, each image being produced at different positions with respect to the first object;~~

an inverting device configured to receive a first plane image of an object and
invert the left and right sides of the first plane image;

a first image display device configured to output the inverted first plane image;

a second image display device configured to output a second plane image of the
object, the first and second images being produced at different positions with respect to
the object, wherein the first and second image display devices are configured to output
substantially simultaneously the inverted first image and the second image, respectively;
and

a mirror configured to receive and reflect the inverted image output from the first
image display device in a direction;

wherein the first and second display devices are located on opposite sides of the
mirror,

and wherein the second display device is arranged to output the second plane
image in the direction.

20. (AMENDED) A method of generating a 3-dimensional image from at least two
plane images, comprising:

receiving first and second plane images of a first object, each image being
produced at first and second positions with respect to the first object, and inverting the
left and right sides of the first and second plane images, respectively;

outputting displaying substantially simultaneously the inverted first and second
plane images for a first object, respectively, each image being produced at first and
second positions with respect to the first object;

~~inverting the left and right sides of the first and second plane images, respectively;~~

configuring a first mirror to receive and reflect the first inverted image in a first
direction; and

configuring a second mirror to receive and reflect the second inverted image in the
first direction;

wherein the first and second mirrors are arranged such that the two mirrors as a
whole are substantially "V" shaped.

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